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(54) **STERILE FILLING SYSTEM**

(57) Cost is reduced as a whole. An aseptic filling system 1A includes a heat sterilizer 18 and a filler 2. The heat sterilizer 18 has a heating unit 12, a holding tube 14, a first stage cooling unit 15 and a second stage cooling unit 16. A circulation line 30 composed of a heating-water line 31 and a cooling-water line 32 is connected to the heating unit 12 and the first stage cooling unit 15. A connection line 33 is connected to the cooling-water line 32, and aseptic cooling water in the cooling-water line 32 is sent to the filler through the connection line 33.

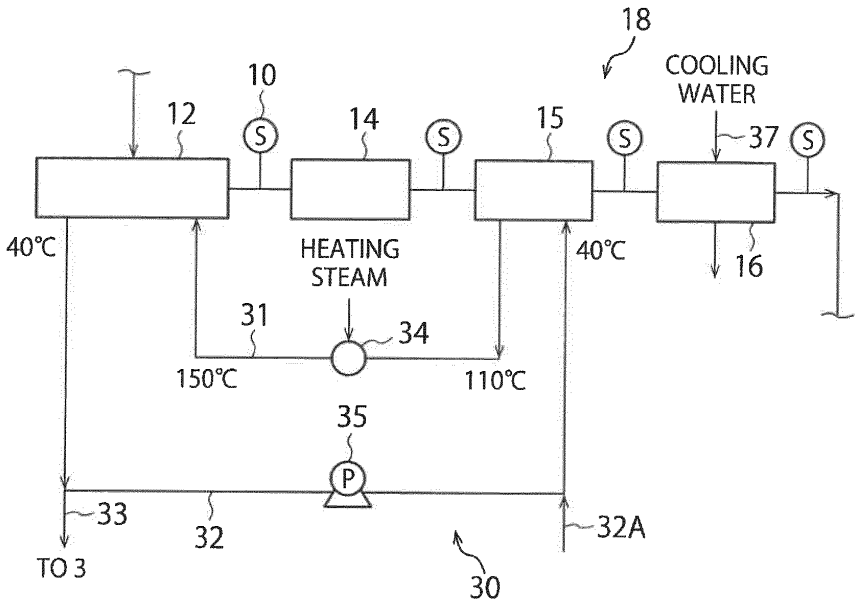


FIG. 1

EP 3 650 401 A1

Description

Field of the Invention

[0001] The present invention relates to an aseptic filling system for filling a container, such as PET bottle, with a beverage (content).

Background Art

[0002] An aseptic filling system for filling a container, such as a bottle, with a beverage has been conventionally known. Such an aseptic filling system comprises a heat sterilizer for heating a beverage, and filling machine. The filling machine includes an aseptic chamber wherein a bottle is filled with a beverage.

[0003] Air having passed through a sterilization filter is supplied into the aseptic chamber of the filling machine, so as to maintain the aseptic condition in the aseptic chamber.

[0004]

Patent Document 1: JP2011-255938A
Patent Document 2: JP2015-44593A

Summary of the Invention

[0005] A heat sterilizer uses heated aseptic water in order to heat a beverage.

[0006] On the other hand, since an aseptic chamber of a filling machine is supplied with a small amount of aseptic water for lubrication or the like, an aseptic-water generator is needed. If the aseptic-water generator can be omitted, installation cost and operation cost can be reduced as a whole.

[0007] The present invention has been made in view of the above problem. The object of the present invention is to provide an aseptic filling system capable of reducing installation cost and operation cost as a whole.

[0008] The present invention is an aseptic filling system comprising: a heat sterilizer that sterilizes a content by heat; and a filling machine that fills a bottle with the content sterilized by heat by the heat sterilizer; wherein: the heat sterilizer includes a heating unit that heats the content, and a cooling unit that cools the content heated by the heating unit; a circulation line that circulates aseptic water is connected between the heating unit and the cooling unit, the circulation line including a heating-water line that supplies the heating unit with heating water from the cooling unit, and a cooling-water line that supplies the cooling unit with cooling water from the heating unit; and the cooling-water line is provided with a connection line that supplies aseptic water to the filling machine.

[0009] The present invention is the aseptic filling system wherein the filling machine includes an aseptic chamber; the connection line is connected to the aseptic chamber through a sprayer or a nozzle; and aseptic water is sprayed into the aseptic chamber by the sprayer or the nozzle.

[0010] The present invention is the aseptic filling system wherein the heating-water line is provided with a heating-steam supply unit.

[0011] According to the present invention, it is not necessary to additionally provide an aseptic-water generator for supplying aseptic water to an aseptic chamber of a filling machine, whereby cost can be reduced as a whole.

Brief Description of the Drawings

[0012]

Fig. 1 is a view showing a heat sterilizer of an aseptic filling system.
Fig. 2 is a block diagram of an aseptic filling system according to the present invention.
Fig. 3 is a view showing a shell-tube type heat exchanger.

Detailed Description of the Invention

[0013] An overall aseptic filling system 1A is firstly described with reference to Fig. 2.

[0014] As shown in Fig. 2, the aseptic filling system 1A is configured to aseptically fill a plastic bottle (also referred to as container) b with a beverage (also referred to as content).

[0015] Such an aseptic filling system 1A comprises a preparation apparatus 1, a balance tank 5, a heat sterilizer (UHT) 18, a serge tank 19, a head tank 11, and a filler (also referred to as filling machine) including a filling nozzle 2a for aseptically filling a bottle b with a beverage, in this order.

[0016] The preparation apparatus 1 is configured to prepare beverages, such as tea beverages or fruit beverages, at respective desired preparation ratio.

[0017] The preparation apparatus 1 and the filling nozzle 2a in the filler 2 is connected through a beverage supply pipe 7.

[0018] In addition, the aseptic filling system 1A is provided with a bottle transport path through which a bottle b is transported to the filler 2, and through which a bottle b filled with a beverage by the filler 2 is discharged. The transport path is generally composed of a plurality of wheels 20, grippers 20A disposed around the respective wheels, and so on.

[0019] The filler 2 is a filling machine that fills a plurality of bottles b with a beverage at high speed. The filler 2 comprises an aseptic chamber 3, a plurality of filling nozzles 2a disposed in the aseptic chamber 3 for filling bottles b with a beverage, and a wheel 20 disposed in the aseptic chamber 3 and constituting a part of the transport path for a bottle b. The wheel 20 is mounted on a pivot shaft 21a extending from a support shaft 21 standing perpendicularly from a floor surface of the aseptic filling apparatus. The grippers 20A that grip a neck part of a bottle b are arranged around the wheel 20 at constant

pitches. The grippers 20A can be rotated integrally with the wheel 20 in one direction. The filling nozzles 2a are mounted around the wheel 20 at the same pitches as the grippers 20A.

[0020] A rotary joint 21b is disposed on an upper end of the pivot shaft 21a extending upward from the support shaft 21. An upper manifold 22 is provided on the pivot shaft 21a below the rotary joint 21b. A part extending from an upper part of the support shaft 21 of the pivot shaft 21a up to the upper manifold 22 is hollow. A downstream pipe part 7b of the beverage supply pipe 7 is connected to the rotary joint 21b. In addition, a connection pipe part 7c extends between the upper manifold 22 and each filling nozzle 2a.

[0021] The wheel 20 is rotated at high speed by actuating the filler 2. In synch with the rotating movement of the wheel 20, bottles b gripped by the grippers 20A are transported on the transport path at high speed. When a bottle b reaches a position directly below a nozzle opening at a lower end of the filling nozzle 2a, the bottle b is filled with a predetermined amount of beverage. In this manner, bottles b are filled with a beverage in succession.

[0022] In order that the filler 2 can fill a sterilized bottle b with a sterilized beverage without any foreign matters such as microorganisms entering into the bottle b, the filler 2 as a whole is housed in the aseptic chamber 3, as described above. The aseptic chamber 3 has an inlet for bottle b, which is provided on the upstream side of the transport path for bottle b, and an outlet for bottle b, which is provided on the downstream side of the transport path for bottle b.

[0023] Next, the aseptic filling system 1A is further described. The beverage supply pipe 7 includes the upstream pipe part 7a and the downstream pipe part 7b. In the upstream pipe part 7a extending from the preparation apparatus 1 to reach the filler 2, the balance tank 5, the heat sterilizer (UHT (Ultra High-temperature)) 18, a manifold valve 8 and the serge tank 19 are disposed in this order from the upstream side to the downstream side. The head tank 11 is disposed in the downstream pipe part 7b.

[0024] The UHT 18 includes a heating unit 12 disposed therein, a holding tube 14, a first stage cooling unit 15 and a second stage cooling unit 16. A beverage supplied from the balance tank 5 is sent to the heating unit 12. The beverage is gradually heated in the heating unit 12, and is held at a target temperature in the holding tube 14. Thereafter, the beverage is sent to the first stage cooling unit 15 and the second stage cooling unit 16 so as to be gradually cooled. The number of stages of the heating unit(s) or the cooling unit(s) is increased or decreased according to need.

[0025] A return path 6 is disposed on the upstream pipe part 7a of the beverage supply pipe 7, which extends through the balance tank 5 and the UHT 18 to reach the manifold valve 8. The return path 6 is provided for performing Sterilizing in Place (SIP), and for circulating a liquid when no liquid can be supplied to the serge tank 19 in order to hold a pressure necessary for the UHT 18 to maintain a temperature of the holding tube 14 at a high temperature exceeding 100°C after starting the sterilization.

[0026] In addition, in the upstream pipe part 7a of the beverage supply pipe 7, temperature sensors 10 are disposed at important positions in terms of operation of the UHT. These positions at which the temperature sensors 10 are disposed, may be, for example, in the path from the heating unit 12 in the UHT 18 toward the manifold valve 8, positions between the respective units in the UHT 18, a position on the downstream side of the second stage cooling unit 16, and a position on the upstream side of the manifold valve 8. The temperature sensors 10 are respectively disposed on these positions. Information about temperatures respectively measured by these temperature sensors 10 is transmitted to a controller 17.

[0027] In addition, in the downstream pipe part 7b of the beverage supply pipe 7, which extends from the serge tank 19 on the downstream side of the upstream pipe part 7a to reach the filler 2 through the head tank 11, the temperature sensors 10 are disposed on respective positions including a poison at which a temperature thereof is not easily elevated when supplied with heating steam or the like. These positions at which the temperature sensors 10 are disposed may be, for example, in the path from the serge tank 19 toward the filling nozzle 2a, a position near an outlet of the serge tank 19, an intermediate position of a bent portion, which is a low position in which steam condenses so that a temperature lowers, a position near an inlet of the head tank 11, and a position near an outlet of the head tank 11. Information about temperatures respectively measured by these temperature sensors 10 is transmitted to a controller 17.

[0028] The heat sterilizer (UHT) 18 includes the heating unit 12, the holding tube 14, the first stage cooling unit 15 and the second stage cooling unit 16. A heating-water line 31 is connected between the heating unit 12 and the first stage cooling unit 15. The heating-water line 31 supplies the heating unit 12 with heating water, such as heating water having a temperature of 110°C, from the first stage cooling unit 15. Further, a cooling-water line 32, which supplies the first stage cooling unit 15 with cooling water, such as cooling water having a temperature of 40°C, is connected therebetween. In addition, a cooling-water line 37, which supplies cooling water, such as cooling water of 10°C, is connected to the second stage cooling unit 16.

[0029] As shown in Fig. 3, the heating unit 12 of the UHT 18, the first stage cooling unit 15 thereof and the second stage cooling unit 16 thereof are respectively formed of a shell-tube type heat exchanger 40 including an outer tube 41 and a plurality of tubes 42 disposed inside the outer tube 41. A beverage flows through the outer tube 41, and heating water or cooling water flows through the tubes 42, so that the beverage is heated or cooled in the outer tube 41.

[0030] The heating-water line 31 and the cooling-water line 32, which are connected between the heating unit 12 and the first stage cooling unit 15, constitute a sealed circulation line 31. Namely, the heating-water line 31 is connected to the heating unit 12 and then joins with the cooling-water line 32, and the cooling-water line 32 is connected to the first stage cooling unit 15 and is connected to the heating-water line 31, so that the heating-water line 31 and the cooling-water line 32 constitute a sealed circulation line closed from outside.

[0031] The heating-water line 31 is provided with a heating-steam supply unit 34 that supplies heating steam to the heating-water line 31. Thus, heating water of e.g., 100°C, which flows through the heating-water line 31, is heated by the heating steam supplied from the heating-steam supply unit 34 up to a high temperature, such as 150°C, so that the heating water turns into aseptic water. Further, the cooling-water line 32 is provided with a pressure pump 35 that pressurizes cooling water.

[0032] Thus, heating water and cooling water, which flow through the circulation line 30, are maintained to be aseptic. Further, a connection line 33 is connected to the cooling-water line 32, and aseptic water flowing through the cooling-water line 32 is supplied to the filler 2 through the connection line 33. Supplemental water is supplied from a supplemental-water line 32A to the cooling-water line 32.

[0033] In this case, the connection line 33 is connected to the aseptic chamber 3 of the filler 2 through a sprayer or a nozzle 3a, so that aseptic water flowing through the connection line 33 is supplied to the aseptic chamber 3 through the sprayer or the nozzle 3a.

[0034] Next, an operation of the embodiment as structured above is described.

[0035] Firstly, a beverage is prepared in the preparation apparatus 1, and is sent from the balance tank 5 to the heat sterilizer (UHT) 18. The beverage is subjected to a heat sterilization process in the heat sterilizer 18.

[0036] Then, the beverage having been sterilized by heat in the heat sterilizer 18 is stored in the serge tank 19, and is thereafter sent to the head tank 11. Thereafter, the beverage in the head tank 11 is supplied to the filler 2 to pass through the filling nozzle 2a in the filler 2, so that a bottle b is filled with the beverage in the aseptic condition. The bottle b filled with the beverage is discharged outside from the filler 2.

[0037] Next, an operation in the heat sterilizer 18 is described in detail below.

[0038] As shown in Fig. 1, a beverage supplied from the balance tank 5 is sent to the heating unit 12 of the heat sterilizer 18. The beverage of, e.g., an ordinary temperature (20°C), is heated in the heating unit 12 up to, e.g., 130°C. While the beverage is being heated from 20°C up to 130°C, the beverage is subjected to a heat sterilization process.

[0039] Then, the beverage having been heated in the heating unit 12 is held or heated in the holding tube 14 by a not-shown heating mechanism up to a target temperature of e.g., 130°C.

[0040] Then, the beverage from the holding tube 14 is cooled in the first stage cooling unit 15, so that its temperature lowers from 130°C down to, e.g., 60°C.

[0041] Further, the beverage having been cooled by the first stage cooling unit 15 is cooled by the second stage cooling unit 16, so that its temperature lowers from, e.g., 60°C down to, e.g., 30°C.

[0042] Then, the beverage having been cooled by the second stage cooling unit 16 is sent to the serge tank 19 through the manifold valve 8.

[0043] During these steps, hot water (heating water like boiling water) having a high temperature of, e.g., 150°C, which flows through the heating-water line 31, is supplied into the heating unit 12, and the beverage is heated in the heating unit 12. The temperature of the heating water that heats the beverage in the heating unit 12 lowers down to, e.g., 40°C. Thus, the heating water having turned into cooling water flows through the cooling-water line 32. Then, the cooling water in the cooling-water line 32 is pressurized by the pressure pump 35, and is supplied to the first stage cooling unit 15. The pressurized cooling water cools the high-temperature beverage in the first stage cooling unit 15. In the first stage cooling unit 15, the temperature of the cooling water elevates from, e.g., 40°C up to 110°C, so that the cooling water turns into hot water (heating water like boiling water). The hot water enters the heating-water line 31.

[0044] Then, heating steam is supplied from the heating-steam supply unit 34 to the heating water flowing through the heating-water line 31, so that the temperature of the heating water elevates from, e.g., 110°C up to 150°C.

[0045] Since the circulation line 30 composed of the heating-water line 31 and the cooling-water line 32, which is shown in Fig. 1, is a sealed line sealed from outside, the heating water and the cooling water flowing through the circulation line 30 are maintained to be aseptic.

[0046] During these steps, aseptic cooling water flowing through the cooling-water line 32 is supplied to the filler 2 through the connection line 33 according to need. Since the connection line 33 is connected to the aseptic chamber 3 of the filler 2 through the sprayer 3a, the aseptic cooling water flowing through the connection line 33 is sprayed into the aseptic chamber 3 through the sprayer 3a, so as to maintain the inside of the aseptic chamber 3 to be aseptic.

[0047] As described above, according to this embodiment, the aseptic cooling water in the cooling-water line 32 of the circulation line 30 is supplied to the filler 2 by the connection line 33 and is sprayed into the aseptic chamber 3, whereby the inside of the aseptic chamber 3 can be maintained to be aseptic. Since aseptic water is supplied into the aseptic chamber 3, it is not necessary to additionally provide an aseptic-water generator. Thus, installation cost and operation cost can be reduced as a whole.

[0048]

1A	Aseptic filling system
1	Preparation apparatus
2	Filler
2a	Filling nozzle
3	Aseptic chamber
3a	Sprayer
5	Balance tank
6	Return path
7	Beverage supply pipe
7a	Upstream pipe part
7b	Downstream pipe part
7c	Connection pipe part
11	Head tank
12	Heating unit
14	Holding tube
15	First stage cooling unit
16	Second stage cooling unit
18	Heat sterilizer
30	Circulation line
31	Heating-water line
32	Cooling-water line
33	Connection line
34	Heating-steam supply unit
35	Pressure pump
37	Cooling water line

Claims

1. An aseptic filling system comprising:

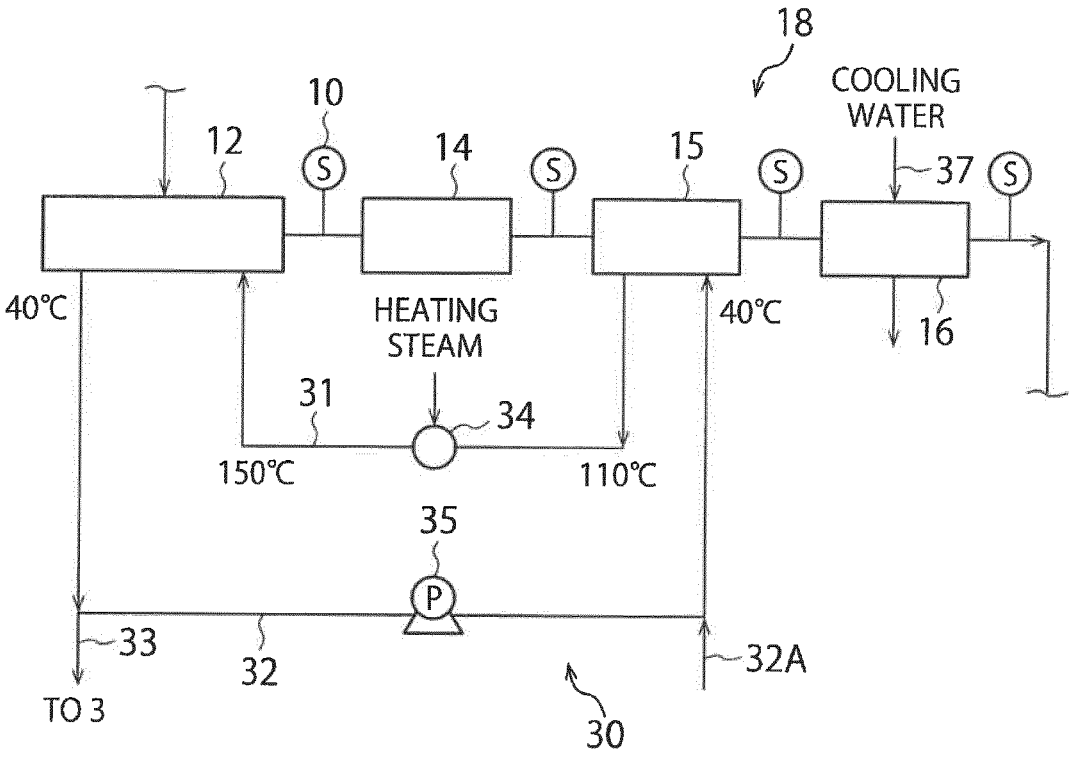
a heat sterilizer that sterilizes a content by heat; and
a filling machine that fills a bottle with the content sterilized by heat by the heat sterilizer;
wherein:

the heat sterilizer includes a heating unit that heats the content, and a cooling unit that cools the content heated by the heating unit;
a circulation line that circulates aseptic water is connected between the heating unit and the cooling unit, the circulation line including a heating-water line that supplies the heating unit with heating water from the cooling unit, and a cooling-water line that supplies the cooling unit with cooling water from the heating unit; and
the cooling-water line is provided with a connection line that supplies aseptic water to the filling machine.

2. The aseptic filling system according to claim 1, wherein:

the filling machine includes an aseptic chamber;
the connection line is connected to the aseptic chamber through a sprayer or a nozzle; and
aseptic water is sprayed into the aseptic chamber by the sprayer or the nozzle.

3. The aseptic filling system according to claim 1 or 2, wherein
the heating-water line is provided with a heating-steam supply unit.


18
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COOLING
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FIG. 1

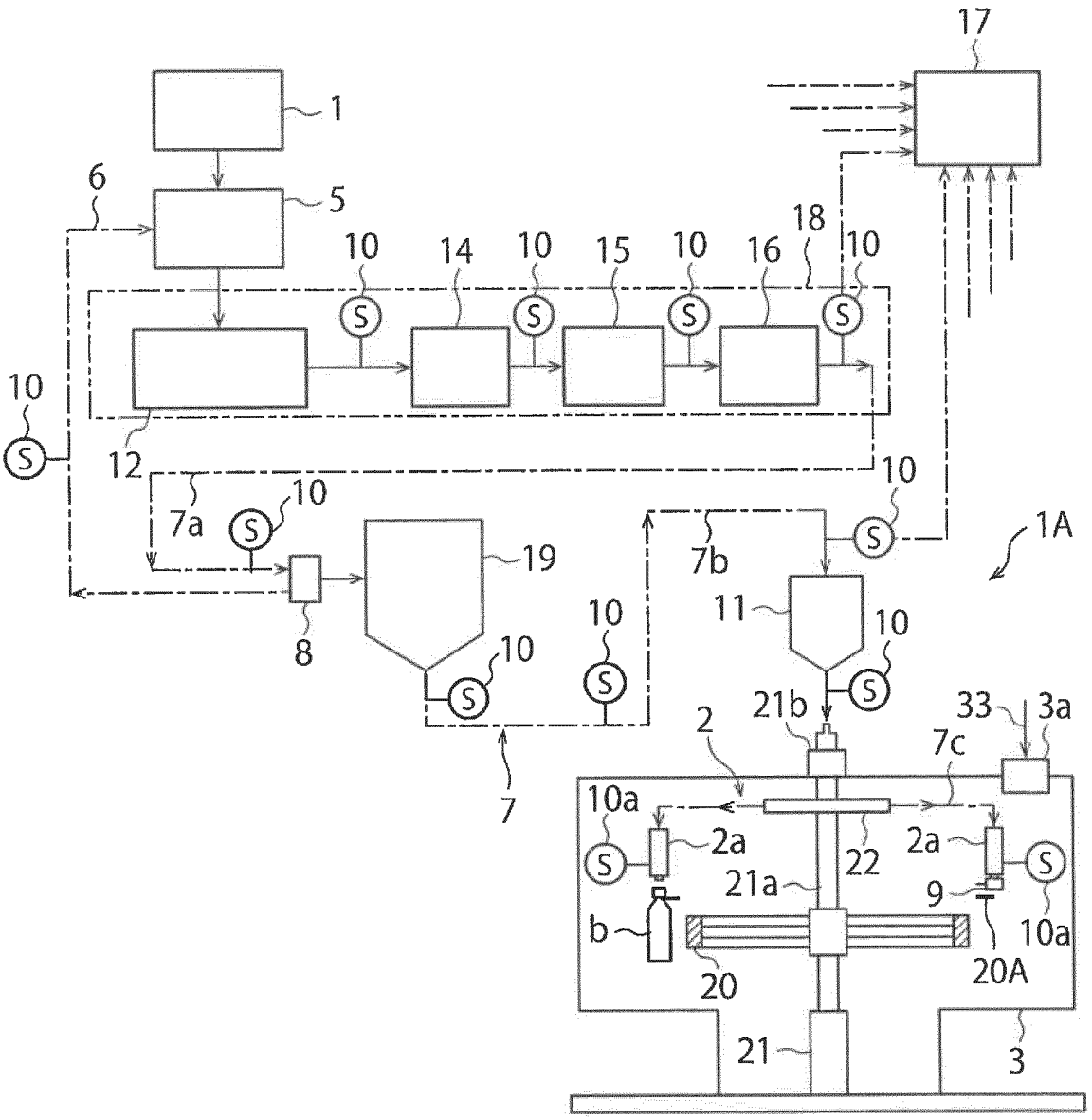
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FIG. 2

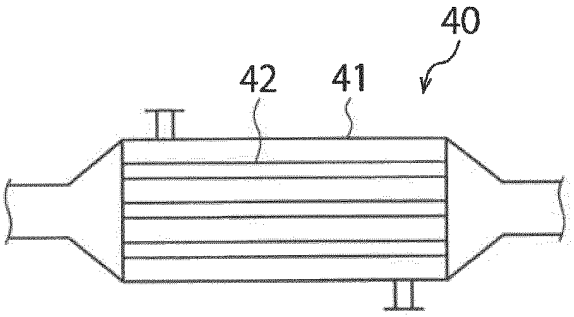
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FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/024512

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B67C3/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. B67C3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 56-74485 A (TOYO SEIKAN CO., LTD.) 19 June 1981, page 3, upper left column, line 14 to upper right column, line 7, upper right column, line 20 to lower left column, line 5, fig. 1 (Family: none)	1-3
Y	JP 2015-6922 A (DAI NIPPON PRINTING CO., LTD.) 15 January 2015, paragraphs [0030]-[0039], fig. 1 (Family: none)	1-3
Y	JP 2007-22600 A (TOYO SEIKAN CO., LTD.) 01 February 2007, paragraph [0018] (Family: none)	1-3

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
06.09.2018	18.09.2018

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/024512

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2014/098058 A1 (DAI NIPPON PRINTING CO., LTD.) 26 June 2014, paragraphs [0029], [0041], [0064] & US 2016/0185584 A1, paragraphs [0040], [0052], [0076] & EP 2937309 A1 & CN 104755411 A	1-3
Y	JP 11-208782 A (DAI NIPPON PRINTING CO., LTD.) 03 August 1999, paragraphs [0036]-[0043], fig. 4 (Family: none)	2-3

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011255938 A **[0004]**
- JP 2015044593 A **[0004]**